MONTANA DEPARTMENT OF FISH AND GAME
ECOLOGICAL SERVICES DIVISION

ANNUAL PROGRESS REPORT

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Project Title: In-situ uranium mining, Long Pines, Montana

Period Covered: September 1, 1976 through August 31, 1977

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INTRODUCTION

The federal government has placed the nation's search for energy self-sufficiency among its highest priorities. Many of the known energy reserves occur in several western states including Montana. Coal reserves in this region have perhaps received most of the publicity, but uranium has also received considerable attention.

The Montana Department of Fish and Game became concerned over the possible adverse impact of mining uranium ore on wildlife populations in a portion of southeastern Montana. Of primary concern was Mobile Oil Corporation's "Foxhills Project" in the Long Pines, a portion of the Sioux District of the Custer National Forest (USFS). The company's activity was directed towards locating a "roll front" uranium deposit in the Foxhills geological formation (Stellingwerf 1975). By 1974 Mobile had staked 1,165 claims, representing approximately 23,000 acres of National Forest lands (Walcheck 1975). If minable ore deposits are located, development of a solution mining technique may serve as an alternative to subsurface or surface mining. Development-minded interests claim that such a method offers only a minimal amount of surface disturbance and the most environmentally compatible means of recovering uranium.

Field work to gather baseline data on wildlife in the Long Pines was initiated during September 1976. It was funded for three years with a grant from the U.S. Fish and Wildlife Service (USFW) through their Office of Biological Services (OBS). The purpose of the project was to fulfill the following objectives:

1) To identify conflicts between in-situ solution mining and wildlife populations and develop criteria for eliminating, reducing, or compensating those conflicts;

2) to furnish ecological data necessary to monitor the effects of solution mining on vegetation and wildlife populations;

3) to utilize the Long Pines as a model demonstration site for researching the compatibility of wildlife habitat and solution mining;

4) to develop revegetation techniques or innovations necessary to replace wildlife habitat disturbed by solution mining or other "in-situ" mining procedures; and

5) to monitor secondary impacts from "in-situ" mining on wildlife populations and develop alternatives to reduce adverse impacts.

Obviously, all of these objectives cannot be met within the scope of this three-year study. However, a long term plan will result from this study enabling all of these to eventually be met if development of

uranium deposits in the Long Pines does occur. This report summarizes the progress of this study during its first year ending August 31, 1977.

STUDY AREA

The study area includes the portion of the Sioux District of the Custer National Forest known as the Long Pines, located in Carter County, Montana (Figure 1). Upland portions occur as a series of ridges in the shape of an "L" rising to approximately 1,200 feet above the surrounding plains. National Forest lands together with private inholdings encompass approximately 65,000 acres (102 sq. mi.). The study area also includes private lands extending from one-two miles out from around the periphery of the forest. The entire study area, which includes both private and public lands, encompasses approximately 122,880 acres (192 sq. mi.). To more easily facilitate gathering and interpreting some of the data, the study area was divided into three subunits (Figure 1), each corresponding to a major drainage within the study area: 1) Snow Creek Unit; 2) Speelman Creek Unit; and 3) Plum Creek Unit.

The Long Pines study area occurs in the Little Missouri River drainage. Drainages on the east side flow directly into the Little Missouri while those on the west side enter into Box Elder Creek, the only permanent stream in the study area. Soils in the area include deep to shallow soils derived from sandstone and shale in the uplands to deep well drained soils on the Box Elder Creek flood plain (SCS, USDA 1972). Geological deposits originating during the Tertiary Period include the Arikaree and Chadron formations and the Ludlow member of the Ft. Union formation (Mont. Bur. Mines and Geol. 1977). Older formations, deposited during the Cretaceous Period, include the Hell Creek and Foxhills formations.

Climatological data for the report period were obtained from that recorded at Ekalaka, Montana and Camp Crook, South Dakota (U.S. Dept. Comm. 1976-1977), lying approximately 20 miles north and three miles off the southeast corner of the study area, respectively. During the report period precipitation was below normal during all months at both stations except January and March 1977 (Table 1). Above normal snowfall during January was accompanied by below normal temperatures resulting in large accumulations of snow cover throughout the study area. Precipitation during March fell as snow during a one-two day period at the end of the month. Camp Crook normally receives less precipitation than Ekalaka from September through March, and this trend was reflected during the report period. Snow cover also persisted for longer periods on the north and west sides of the Long Pines than on the east side. Temperatures reported for Ekalaka were above normal during all months except October, November, January and August. Normal monthly temperatures were not available for the Camp Crook station.

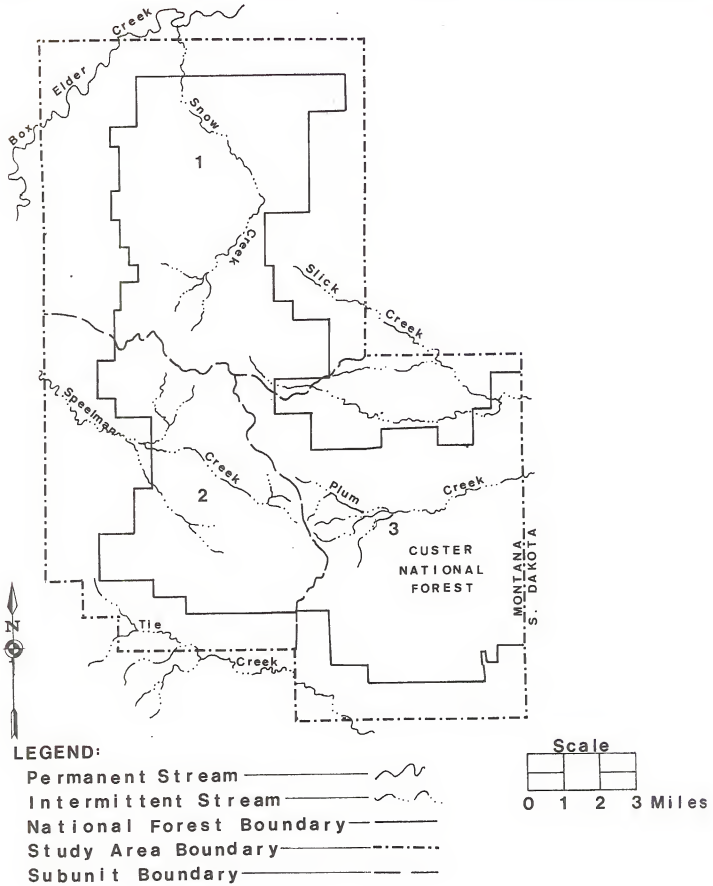

Figure 1. The Long Pines study area in Carter County, Montana.

Table 1. Climatological data from two reporting stations near the Long Pines Study area during the period of September 1976 through August 1977.

	EKALAKA, MONTANA				CAMP CROOK, SOUTH DAKOTA				
	Temperature		Precipitation			Temperature		Precipitation	
Month	Ave.	Dep. from Normal	Total	Dep. from Normal	Month	Ave.	Dep. from Normal	Total	Dep. from Normal
September	62.0	4.5	.49	-.92	September	61.5	-	.46	-.74
October	43.0	-4.0	.68	-.05	October	43.5	-	.51	-.13
November	25.7	-5.7	.13	-.44	November	27.1	-	.12	-.28
December	23.7	.8	.35	-.05	December	25.5	-	.22	-.07
January	8.7	-8.8	1.11	.65	January	8.1	-	.53	.18
February	30.1	7.6	.31	-.10	February	31.1	-	.07	-.26
March	34.6	6.0	1.39	.76	March	35.2	-	1.46	.97
April	48.4	5.6	.21	-1.09	April	47.9	-	.21	-1.10
May	61.1	7.5	.98	-1.27	May	61.0	-	1.33	-.90
June	67.5	5.6	3.34	-.33	June	69.3	-	1.85	-1.34
July	72.1	1.6	.94	-.95	July	73.3	-	.98	-.73
August	64.4	-5.1	1.20	-.30	August	64.5	-	.95	-.58

SCOPE OF WORK

Effort during the report period was directed exclusively to three phases of the study, which included work related to vegetation analysis, a wildlife ecology study, and an evaluation of recreational use of the study area. Phases dealing with revegetation techniques, secondary impacts, and impacts resulting directly from solution mining will receive attention after field work in the Long Pines has been completed.

Analysis of Vegetational Communities

Work related to this phase included obtaining a preliminary cover map and identifying vegetational communities that occurred on the study area. Twenty plots at each of eight sites were analyzed among several plant communities using a method similar to that described by Daubenmire (1959). These data have not yet been analyzed. Numerous sites yet remain to be analyzed and this task will be completed during July 1978.

Shortly after the study was initiated, 24 cover types were identified based on recognizable vegetational characteristics. During April 1977, a preliminary cover map was completed. The mapping was contracted to Ecological Consulting Services, Inc. of Helena. False-color infrared film (1:80,000 scale), was used to make the photo interpretation. The completed mylar map of major vegetation types and surface hydrology were drawn at a scale of 1:24,000. Six habitat types and one cover type were delineated on the cover map.

For purposes of this study vegetation on the study area was described in terms of habitat types as defined by Daubenmire (1968). Since obtaining the vegetation map, 11 habitat types in addition to the agricultural cover type have been tentatively identified:

1) *Pinus ponderosa/Andropogon scoparius* h.t.
2) *Pinus ponderosa/Agropyron* h.t.
3) *Pinus ponderosa/Rhus trilobata* h.t.
4) *Pinus ponderosa/Symphoricarpos albus* h.t.
5) *Pinus ponderosa/Juniperus* h.t.
6) *Agropyron-Stipa* h.t.
7) *Artemisia/Apropgron* h.t.
8) *Artemisia/Chrysothamnus* h.t.
9) *Populus tremuloides* h.t.
10) *Populus/Symphoricarpos* h.t.
11) *Fraxinus pennsylvanicus-Acer negundo/Symphoricarpos* h.t.

Some of the forested habitat types are similar to types described by Pfister et al.(1977).

Wildlife Ecology Study

White-tailed Deer

White-tailed deer (*Odocoileus virginiana*) appeared to be the most abundant and widely distributed game species in the study area. Observations were more numerous in the dense forested portions in the south half of the study area than in the north end, which was characterized by open savanna. Whitetails were also quite abundant along the Tie Creek drainage at the south edge of the study area. Population density in terms of deer/square mile, has not yet been quantified. We intend to coordinate our efforts directed toward both species of deer with those of the statewide deer study being conducted by the Research Bureau within the Wildlife Division.

Range Use

Use of Habitat Types

Seasonal use of habitat types by white-tailed deer for the period of December 1976 through August 1977 was evaluated from 681 observations of individual deer. Most of those were obtained from ground surveys since deer were difficult to observe in timber from a fixed-wing aircraft. The following data reflect habitat use during periods of activity (Table 2).

Winter: During winter the *Pinus ponderosa/Symphoricarpos albus* (Pp/Sa) habitat type received the greatest use by white-tailed deer, accounting for 56 percent of seasonal observations. Also receiving appreciable use were the *Agropyron-Stipa* (A-S) and *Fraxinus pennsylvanicus-Acer negundo/Symphoricarpos albus* (Fp-An/Sa) habitat types (Table 2). During January, when snow cover was greatest, whitetails appeared to use portions of the Pp/Sa habitat type consistently as feeding areas with trails established to and from such areas.

Spring: Spring brought about a major shift in habitat use by white-tailed deer during periods of activity. As compared to winter, use of timbered habitat types decreased, corresponding with increased use of the A-S habitat type and agricultural cover type, which accounted for 43 and 25 percent of seasonal observations, respectively. Deer used croplands and hay meadows in nearly equal proportion during spring. Most observed use of agricultural areas occurred in the Tie Creek drainage at the extreme southern edge of the study area. This seasonal pattern of habitat use was perhaps largely influenced by new herbaceous growth in such areas.

Table 2. Seasonal use of habitat types in the Long Pines study area by white-tailed deer.

Habitat Type	Winter 1976-77 (183)[a]	Spring 1977 (286)	Summer 1977 (212)
Pinus ponderosa/Andropogon scoparius	4[b]	1	1
Pinus ponderosa/Agropyron	6	2	17
Pinus ponderosa/Rhus trilobata	1	1	1
Pinus ponderosa/Symphoricarpos albus	56	17	36
Agropyron-Stipa	14	43	11
Artemisia/Agropyron	2	6	2
Artemisia/Chrysothamnus	-	-	-
Fraxinus-Acer/Symphoricarpos albus	14	5	12
Populus tremuloides	-	-	1
*Populus/Symphoricarpos**	-	-	-
Agricultural Cover Type			
Cropland	2	14	1
Hay Meadow	-	11	16

[a] Samples size for a respective season.

[b] Percent of seasonal observations

* The habitat type was identified following the data collection period.

Summer: During summer white-tailed deer increased their use of timbered habitat types (Table 2). The comparatively dry conditions during summer 1977 may have influenced this pattern. The Pp/Sa and *Pinus ponderosa/Agropyron* (Pp/A) habitat types accounted for 36 and 17 percent of summer observations, respectively. The agricultural cover type received 17 percent of the seasonal use, most of which occurred in hay meadows along Tie Creek. Use of the Fp-An/Sa habitat type also increased from spring to summer.

Use of Slopes and Exposures

During the report period gradient and exposure occupied by deer when first observed were recorded. Results appear in Tables 3 and 4.

Distribution of white-tailed deer among the various classes of slope and exposure appeared largely influenced by seasonal patterns of use among habitat types. Seventy-six percent, or more, of the observations occurred on slopes of 15 degrees or less during all seasons (Table 3). Whitetails were rarely observed on slopes steeper than 30 degrees.

Except during winter, drainage bottoms, which included both coulee and creek bottoms, received major use (Table 4). During fall and summer ridgetops also received substantial use. Observations of deer, associated with some degree of slope, mostly occurred on east exposures, particularly during winter.

Movements

From December 1976 through March 1977, 31 white-tailed deer were captured and individually marked for the purpose of monitoring seasonal and annual movement patterns. This was facilitated by use of an "Oregon" deer trap at each of seven sites. Severe weather conditions enhanced trapping success during January 1977 since 20 of the 31 deer were captured during that period. The sample included 13 adults and 18 fawns. Adults included seven females (1½+), two yearling males, and four older males, while the two sexes were equally represented among fawns.

Four animals, all adult females, were fitted with collars containing radio transmitters. Two of the collars consisted of two-inch polyvinyl chloride pipe (PVC) molded into a diamond shape with a 21-inch circumference. Two additional radio collars were constructed from 1⅛-inch Tygon tubing which was flexible and could be adjusted to fit individual neck sizes. Transmitting and receiving equipment was obtained from AVM Instrument Company. Radioed animals were located at one to two week intervals from a fixed-wing aircraft. On several occasions animals were located by ground and aerial means throughout different periods of the day.

Table 3. Seasonal use of four classes of gradient by white-tailed deer.

Gradient	Fall 1976 (72) [a]	Winter 1976-77 (183)	Spring 1977 (353)	Summer 1977 (194)
0-15°	76[b]	76	87	78
16-30°	18	18	11	19
31-45°	6	5	2	2
46° +	-	-	-	1

[a] Sample size for a respective season

[b] Percent of seasonal observations.

Table 4. Seasonal distribution of white-tailed deer among flat lands and exposures.

Exposure	Fall 1976 (64)[a]	Winter 1976-77 (183)	Spring 1977 (353)	Summer 1977 (194)
Level Ridgetop	27[b]	15	16	29
Level Bottoms	30	26	37	34
North	12	9	9	9
East	17	26	19	12
South	6	15	13	5
West	8	8	5	10

[a] Sample size for a respective season

[b] Percent of seasonal observations.

The other 27 whitetails were fitted with individually recognizable collars. Two types were used which included five-inch wide collars made from Armortite fabric (ATV 22) with symbols and numbers painted on with "Ritchey" marking paint. The other was a three-inch wide band consisting of various color combinations of "Saflag" material sewn on to canvas webbing. In addition to collars, a plastic livestock ear tag was affixed to the left ear of each fawn captured with a symbol representing the capture site. A numbered metal tag was affixed to the right ear of all deer captured to provide data in the event the animal was found dead or taken by a hunter with no other individually identifiable material present. As opposed to the use of radio tracking equipment, locating neck-banded animals by direct observation was dependent on cover conditions.

Sixty-nine fixes were obtained on the four radio-equipped does from late February 1977 through the end of the report period. One animal lost her radio collar during late May and another lost hers during mid-June. An additional radio quit working during late August. One radio was still transmitting by the end of the report period. Ten neckbanded whitetails were reobserved one or more times accounting for 22 relocations. One of these, a male fawn belonging to one of the radioed does, was observed six times between March and August in the Tie Creek drainage. Six of the 27 neckbanded deer were found dead. Four, which included three fawns, succumbed to causes related to malnutrition and two were killed by automobiles.

None of the movement data has yet been evaluated. Data from radioed animals will eventually be placed on a computer file. Seasonal and annual home ranges, centers of activity and standard diameters will be obtained from the data.

Food Habits

Semi-seasonal food habits of white-tailed deer were evaluated from analysis of 39 rumens (Table 5) using a method described by Wilkins (1957), Mackie (1970) and others. Samples were taken from late October 1976 through August 1977. Sixteen samples taken during late fall were from deer killed by hunters; 18 were from animals taken on a collecting permit from December through August; and five miscellaneous samples were taken from deer killed by predators, automobiles, trap mortality and poaching. All but two were taken from the portion of the study area consisting of National Forest. Agricultural crops occurring in samples generally reflected deer moving from the forest to adjacent private lands to feed.

Fall

As mentioned previously all samples gathered during this season were taken during late fall. Browse, forbs, and grasses accounted for 63, 23, and 12 percent of the diet during that period, respectively. Oregon grape (*Berberis repens*) and snowberry (*Symphoricarpos* spp.) were

Table 5. Semi-seasonal food habits of white-tailed deer in the Long Pines, Carter County, Montana, from late October 1976 through August 1977 as determined from analysis of 39 rumens.

Taxa	Late Fall '76 (16)[a]	Early Winter '76-'77 (6)	Late Winter '77 (3)	Early Spring '77 (3)	Late Spring '77 (4)	Early Summer '77 (3)	Late Summer '77 (4)
BROWSE:							
Amelanchier alnifolia	19/ 3[b]	-	-	-	50/tr[c]	33/tr	-
Arctostaphlos uva-ursi	6/tr	17/tr	-	-	-	-	-
Berberis repens	81/32	100/43	100/41	67/42	-	-	50/ 1
Cornus stolonifera	-	-	-	-	-	33/tr	-
Crataegus succulenta	-	17/ 3	-	-	25/ 2	-	-
Juniperus communis	6/tr	17/tr	-	33/tr	-	-	-
Pinus ponderosa	37/ 1	50/ 8	100/20	67/32	100/tr	-	-
Populus tremuloides	6/tr	17/tr	67/ 3	33/tr	50/ 1	-	-
Betula papyrifera	-	17/tr	-	-	-	-	-
Prunus americana	-	17/tr	33/ 1	-	25/tr	-	-
Prunus virginiana	44/ 2	83/11	100/17	33/ 4	75/ 5	100/14	100/24
Rhus trilobata	12/tr	-	-	-	25/tr	-	-
Ribes spp.	-	-	33/tr	-	25/tr	-	25/tr
Rosa arkansana	75/ 1	67/tr	33/tr	33/tr	100/ 4	100/ 3	75/ 2
Shepherdia argentea	-	-	-	-	-	-	25/tr
Symphoricarpos spp.	100/24	100/22	100/ 9	100/ 8	75/13	100/45	75/30
Unidentified Browse	12/tr	50/ 1	100/tr	67/tr	50/tr	67/ 6	75/ 5
TOTAL BROWSE	100/63	100/88	100/91	100/86	100/25	100/68	100/62
FORBS:							
Anemone patens	-	-	-	-	25/ 8	33/tr	-
Antennaria parvifolia	44/ 1	-	-	-	-	-	-
Artemisia dracuncus	-	33/tr	-	-	-	-	-
Artemisia frigida	6/tr	17/tr	33/ 4	33/ 1	-	-	-
Artemisia ludoviciana	-	17/tr	-	-	-	-	25/tr
Aster spp.	56/ 7	17/tr	-	-	-	-	-
Chrysopsis villosa	25/ 2	83/ 3	33/tr	-	-	-	-
COMPOSITAE	-	-	-	-	-	33/tr	-
Glycyrrhiza lepidota	31/ 1	12/tr	33/ 2	33/ 2	-	33/tr	50/tr

Table 5. continued

Taxa	Late Fall '76 (16)	Early Winter '76-'77 (6)	Late Winter '77 (3)	Early Spring '77 (3)	Late Spring '77 (4)	Early Summer '77 (3)	Late Summer '77 (4)
FORBS: continued							
LEGUMINOSAE	19/tr	33/tr	33/tr	-	-	-	-
Medicago sativa	6/tr	-	-	-	25/21	-	25/tr
Melilotus officinalis	12/ 3	-	-	-	25/tr	-	-
Myrophyllum spp.	6/tr	50/tr	33/tr	-	-	-	-
Penstemon spp.	-	-	-	-	25/tr	-	-
Ratibida columnifera	-	-	-	-	25/ 8	33/ 9	25/tr
Solidago spp.	-	-	-	-	25/tr	33/tr	25/tr
Taraxicum officinale	-	-	-	-	25/ 1	-	-
Tragopogon dubius	31/tr	17/tr	-	-	-	33/tr	25/16
Urtica dioica	-	-	-	-	-	-	25/tr
Yucca glauca	6/tr	-	-	-	-	-	-
Unidentified Forbs	100/ 9	83/ 1	33/tr	100/ 5	75/27	67/18	100/17
TOTAL	100/23	100/ 4	100/ 6	100/ 8	100/65	100/27	100/33
GRASSES:							
Agropyron spp.	-	-	-	-	25/tr	-	-
Andropogon scoparius	6/tr	-	-	-	-	-	-
Avena spp.	-	-	-	-	-	-	25/tr
Hordeum vulgare	6/ 4	-	-	-	-	-	-
Koeleria cristata	6/tr	-	-	-	-	-	-
Poa spp.	-	-	-	-	50/ 2	-	-
Triticum aestivum	6/ 6	-	-	-	-	-	-
Unidentified Grasses	69/ 2	33/ 3	33/tr	67/ 4	75/ 6	33/ 2	50/ 3
TOTAL	75/12	33/ 3	33/tr	67/ 4	100/ 8	33/ 2	75/ 3
OTHER:							
Tree Moss	37/ 1	33/ 3	100/ 1	-	-	-	50/tr
Mushrooms	-	-	-	-	-	33/ 1	25/tr
Bracket fungi	6/tr	17/ 1	100/ 1	-	-	-	-
Lichens	6/tr	-	-	-	-	-	-

Table 5. continued

[a] Sample size for a respective period.

[b] Frequency (precent occurrence among samples)/Percent of diet.

[c] tr - Trace (a value less than .5 percent).

used most heavily during late fall, and the two combined accounted for 56 percent of the diet during that period (Table 5). Most prevalent among forbs in the diet during late fall were aster (*Aster* spp.), yellow sweetclover (*Melilotus officinalis*), and golden aster (*Chrysopsis villosa*). Barley (*Hordeum vulgare*) and wheat (*Triticum aestivum*), both domestic species, accounted for the bulk of the grass forage class during late fall.

Winter

Browse, forbs, and grasses accounted for 88, 4, and 3 percent by volume, respectively, of 6 samples taken from December 1 through January 15. Whitetails increased their use of Oregon grape while that on snowberry remained similar to that observed during late fall (Table 5). The two combined accounted for 65 percent of the diet during early winter. Ponderosa pine (*Pinus ponderosa*) and chokecherry were also consumed in appreciable quantities during that period. Golden aster was the only forb used in measurable quantity during early winter. Tree moss was also consumed in measurable quantities during that period.

Use of browse increased to its highest yearlong level during late winter averaging 91 percent by volume among three rumens gathered during the period. Oregon grape, chokecherry, and ponderosa pine combined accounted for 78 percent of the diet during that period. Snowberry dropped in use as compared to early winter (Table 5). Forbs occurring in the diet during late winter in measurable quantities included wild licorice (*Glycyrrhiza lepidota*) and fringed sagewort (*Artemisia frigida*). Use of grasses during that period was negligible. Deer also continued to use tree moss and bracket fungi.

Spring

Food habits during early spring were quite comparable to those of late winter (Table 5). Browse, forbs, and grass averaged 86, 8, and 4 percent, respectively, of the volume among three rumens collected from March 1 through April 15. Consumption of Oregon grape remained high and use of ponderosa pine increased from late winter.

The spring greenup during the period of April 16 through May 31 brought about a major change in the food habits of white-tailed deer in the study area. Use of browse ebbed to its lowest point of the year accounting for 25 percent of the diet, while forbs accounted for its highest use (65 percent). A wide variety of forbs were used, none of which occurred in more than one of four samples (Table 5). Some of these included pasque flower (*Anemone patens*), alfalfa (*Medicago sativa*), and prairie coneflower (*Ratibida columnifera*). Browse used most often during late spring included snowberry, chokecherry, and prairie rose (*Rosa arkansana*). Identifiable grasses consisted of bluegrasses (*Poa* spp.).

Summer

Use of browse by whitetails increased from late spring and again became the most abundant forage class in the diet during early summer, accounting for 68 percent of the diet during that period. Snowberry and chokecherry accounted for most of the use among browse (Table 5). A variety of forbs were identified in the rumens, none of which occurred in more than one sample. Use of grasses dropped off from that observed during late spring. This pattern of heavy use of browse during this period perhaps reflected the unavailability of forbs due to abnormally dry conditions during the late spring and summer of 1977.

Food habits during late summer were quite similar to those of early summer except that use of chokecherry increased while that of snowberry decreased a little (Table 5). One sample taken along the flood plain of Tie Creek included forbs in greater proportion than browse. This perhaps reflected a greater availability of forbs in flood plain areas as compared to the timbered uplands.

Population Characteristics

During the report period 812 white-tailed deer were classified, primarily from ground surveys, as to age (adult, yearling male, or fawn), sex (adults 1½+) and the type of group they were associated with. Sex and age composition was also recorded among samples of hunter-killed deer, deer that were trapped from December through March, and among carcasses found on the study area during spring 1977.

Group Behavior

Average group sizes of white-tailed deer by season were 2.0, 2.5, 3.7, and 1.7 animals per group during fall, winter, spring and summer, respectively. Groups larger than 10 animals were almost invariably associated with nontimbered habitat types, particularly in the agricultural cover type.

Except during summer, the type of group most commonly observed was a single adult doe accompanied by fawn(s) (Table 6). The proportion of groups containing more then one doe accompanied by fawns increased from fall to winter. Adult bucks (2½+) were rarely observed with doe/fawn groups except for the period of late November through December. Males accompanying does or doe/fawn groups during the remainder of the year were almost invariably yearlings. Even such instances were not common (Table 6). Observations of solitary adults of both sexes were most common during summer.

Table 6. Group characteristics of white-tailed deer in the Long Pines study area.

Group Class	Fall 1976	Winter 1976-77	Spring 1977	Summer 1977
Unclassified	- / -	4/ 9	35/55	1/ 1
Solitary Adult Male	22/11[a]	11/ 4	-/ -	21/12
Adult Male Group	2/ 3	1/ 1	-/ -	7/10
Solitary Adult Female	11/ 5	9/ 3	5/ 1	35/20
Adult Female Group	2/ 3	6/ 5	-/ -	6/ 7
Single Ad. Fem. and Fawn(s)	43/50	36/36	25/16	19/25
Ad. Fem. Group and Fawns(s)	9/14	13/25	4/ 3	4/ 8
Mixed[b]	7/11	4/ 3	2/ 9	5/13
Fawn(s)	4/ 2	7/ 5	5/ 2	2/ 1
Unclassified adults	-/ -	9/ 8	25/14	1/ 1

[a] Percent of total groups observed during a respective period/percent of total animals observed during that period.

[b] Included groups of adult males and females whether accompanied by fawns or not.

Population Structure and Postnatal Production

Population composition, and postnatal production were determined from observed fawn:doe, fawn:adult, and buck:doe ratios as well as the percent increment (Table 7). Such information was obtained primarily from routine ground surveys.

Fall ratios were calculated from data prior to and during the hunting season. Fawn:doe, fawn:adult, and buck:doe ratios during that period were 89:100, 65:100 and 36:100, respectively. Fawns accounted for 40 percent of the population during that period.

Early winter reflected a higher fawn:doe and fawn:adult ratio and a lower buck:doe ratio (Table 7). Fawns accounted for 48 percent of this sample during that period. Based on hunter-harvest data, provided by a questionnaire distributed among hunters during the previous fall, 66 percent of 35 whitetails reported killed were males (regardless of age). Among 29 hunter-killed whitetails examined in the field, 66, 24, and 10 percent were antlered bucks, does, and fawns, respectively. These data tend to support the conclusion that fawns accounted for a greater portion of the early winter population than they did during fall since a very large proportion of the hunter harvest consisted of adults, particularly males.

Fawn:doe and buck:doe ratios were not available during late winter and spring since the sex of adults in the sample during those periods was not readily determined. Fawn:adult ratios during the respective periods were 67:100 and 65:100 considerably lower than that observed during early winter (Table 7). Fawns accounted for 40 percent of the sample during both periods.

Since fawns constituted a greater proportion of deer trapped during winter 1976-77 than did adults, fawns were obviously more vulnerable to trapping then were adults. Assuming that one sex of fawns wasn't more vulnerable to trapping than the other, both males and females occurred in the population in nearly equal proportion - at least into the winter. Remains of eleven white-tailed deer carcasses, believed to have died during winter or early spring, were examined throughout spring and early summer 1977. Gross examination of the femur marrow of eight of those indicated that six (75 percent) had succumbed to causes resulting from or influenced by malnutrition. Eight (73 percent) of the eleven deer were fawns during the previous winter, suggesting that fawns were perhaps more succeptible to winter mortality than were adults. Three of 18 individually marked fawns were among the sample of examined carcasses, representing an observed minimum attrition rate among marked fawns of 17 percent. Sex was determined for seven of the fawn carcasses by absence or presence of a pedicel. This sample consisted of four males and three females. The sample size wasn't adequate to indicate any differential mortality. The preceding data appeared to substantiate a decline in the fawn segment from early winter to spring (Table 7) to a proportion compared to that observed during the previous fall.

Table 7. Population characteristics of white-tailed deer in the Long Pines study area.

Season	Adults				Fawns	Total	Fawns: 100 Does	Fawns: 100 Ad.	Bucks: 100 Does	Percent* Increment
	Fem.	Yr. M.	Ad. M.	Uncl.						
Fall 1976	36	5	8	-	32	81	89	65	36	40
Early Winter 1976-77	43	4	7	-	49	103	114	91	26	48
Late Winter 1977	20	-	1	25	31	77	-	67	-	40
Spring 1977	17	-	-	189	135	341	-	65	-	40
Early Summer 1977	45	10	28	2	9	94	20	11	84	10
Late Summer 1977	59	11	8	-	38	116	64	49	32	33

* The proportion of the population consisting of fawns.

Since newborn fawns were not observed consistently until August, fawn:doe and fawn:adult ratios did not accurately reflect actual production during summer 1977. The early summer buck:doe ratio was perhaps overestimated. Due to fawning occurring during that period, adult bucks may have been more readily observable during summer than during other seasons.

Prenatal Production

Eight does, all two and one-half years or older, were collected from January through May 1977. All were pregnant averaging two fetuses per doe (200 fetuses:100 does 2½+). Six does carried twin fetuses, one carried a single, and another carried triplets. Fourteen of the 16 fetuses were sexed which included twelve males and two females. The recruitment of 1976 female fawns into the adult population as yearlings in 1977 would likely dampen postnatal fawn:doe ratios as compared to the high prenatal fawn:doe ratio reflected by mature females. The uterus was examined from a female fawn during early January and no evidence of it being pregnant was observed. However, Cheatum and Morton (1946) reported that of female fawns reaching sexual maturity, most bred approximately one month later than adult does following the peak of breeding, and the external appearance of the uterus does not change within the first 20 days of pregnancy. The ovaries of the fawn were not recovered. No yearling does were obtained during the January-May period. It would be desirable to have these yearling does represented in the sample since they are more sensitive to nutritional quality as reflected by the incidence of pregnancy among this age class (Verme 1969).

Ovaries were grossly examined by a technique described by Cheatum (1949) to determine the ovulation rate. A doe collected during early December, which was 10½ or older and in poor physical condition, had not ovulated. One corpora lutea was present in a doe collected during late December. It was possible that she was in estrus when she was collected since she was accompanied by an adult buck. Ovaries were obtained from seven of the eight adult does taken from January through May. Thirteen corpora lutea of pregnancy were present among the seven animals reflecting an ovulation rate of 1.86. A total of 13 fetuses were present among those seven does reflecting a fertilization rate of 100 percent.

Forehead-rump measurements were taken from 14 of the 16 fetuses from seven of the eight pregnant does. Breeding dates for each of those does were determined by use of an embryonic growth curve (Cheatum and Morton 1946). The approximate date of conception was determined from counting back from the age of the fetus in days. All seven does were bred between November 11 and December 6, 1976. Assuming an average gestation period of 201 days (Seveninghaus and Cheatum 1956), parturition would have occurred, had those animals lived, between June 5 and July 2, 1977. The first newborn fawn was observed on June 14.

Weights and Physical Condition

Each of 17 white-tailed deer was weighed prior to dressing and again after viscera were removed. A dressing index, dressed weight

expressed as a percentage of whole weight, was calculated for each. Whole and dressed weights for three adult does (2½ +) taken during winter averaged 111 and 74 pounds, respectively (Table 8). Five does taken during spring averaged 105 and 72 pounds, respectively. Three adult does taken during late summer exhibited average whole and hog-dressed weights of 109 and 73 pounds. Although dressing indices varied between individual females, averages during those three periods were 67, 69, and 67 percent, respectively. A similar relationship of whole to hog-dressed weights has been reported for elk (Quimby and Johnson 1951), but several factors, such as physical condition, blood loss and amount of material in the paunch, may somewhat influence this ratio. Hog-dressed weights of whitetail does, taken from the study during the three seasons mentioned above, were approximately 30 percent less than those of similar age classes weighed at check stations throughout Montana during the hunting seasons of 1948-1963 (Mackie 1964).

A kidney fat index was calculated for each of 13 white-tailed deer during the report period (Table 8) using a method described by Allen (1968). The indices generally indicated a decline in the proportion of fat to kidney by weight from winter to late spring. Ransom (1965) found kidney fat indices to be a good indicator of physical condition providing indices remain at or above 30 percent, while femur marrow fat was a better indicator of condition when kidney fat indices fell below that level. With one exception, all animals collected on the study area from December through March exhibited kidney fat indices well above 30 percent. Those during April and May exhibited values below that level (Table 8). Gross examination was made on femur marrow on two of the latter sample. That of an adult doe was white and firm suggesting little or no fat had been mobilized, while that of a male fawn was soft and red in color suggesting that marrow fat was being mobilized.

Mule Deer

Mule deer (*Odocoileus hemionus*) occurred primarily in or near the fringes of forested portions of the study area or in grassland areas interspersed with rough breaks. Effort devoted to this species during the report period consisted largely of gathering range use and population data, which were gathered in a manner similar to that used for white-tailed deer. Aerial surveys were relied on more heavily to gather these data for mule deer, as compared to white-tailed deer, since the portion of the study area occupied by mule deer could be more adequately surveyed from the air. Some food habits data were obtained during the report period also. Due to limitations in time and manpower, data related to movements, prenatal production, and physical condition were not obtained. More effort will be directed toward gathering such data for mule deer as research needs concerning white-tailed deer are completed.

Range Use

Range use data were obtained during periods of the day when animals were presumably most active. During the report period seasonal trends

Table 8. Sex, age, weights and kidney fat indices for white-tailed deer collected in the Long Pines study area.

Date of Collection	Sex	Assigned Age	Whole Weight	Dressed Weight	Dressing[a] Index	Kidney[b] Fat Index
12/05/1976	F	10½+	-	-	-	10
12/28/1976	F	2½-4½	125	80	64	74
01/03/1977	F	½	65	49	75	91
01/14/1977	M	1½	100	70	70	43
01/23/1977	F	8½+	-	-	-	103
02/07/1977	F	10½+	100	70	70	40
02/23/1977	F	4½	108	73	68	32
03/05/1977	F	2½-4½	95	68	72	100
03/21/1977	F	2½-4½	90	64	71	95
04/06/1977	F	2½-4½	96	64	67	15
04/19/1977	F	4½	121	81	67	20
05/16/1977	M	½	75	51	68	9
05/16/1977	F	2½-4½	125	85	68	17
06/16/1977	M	2½	95	65	68	*
06/23/1977	F	1½	70	50	71	*
07/07/1977	M	2½	95	68	72	*
07/19/1977	F	3½	115	80	70	*
08/03/1977	F	4½	115	75	65	*
08/24/1977	F	2½-4½	98	65	66	*

[a] Dressed weight expressed as a percentage of whole weight.

[b] Kidney fat expressed a percentage of the kidney by weight.

* Data unavailable at time of writing

in range use were evaluated from 721 observations of individual deer. Fifty-two percent of 694 observations during the combined periods of winter, spring, and summer were obtained from aerial surveys. During those seasons, each of the three subunits (Figure 1) was surveyed with the use of a fixed-wing aircraft. The Snow Creek, Speelman Creek, and Plum Creek subunits accounted for 45, 17, and 38 percent of 364 aerial observations, respectively.

Use of Habitat Types

Winter: During winter 1976-77, 46 and 56 percent of seasonal observations of mule deer occurred in forested and non-forested habitat types, respectively. Among individual types the A-S type received 33 percent of the observed use, followed by the Pp/A, Pp/Sa, and *Artemisia/Agropyron* (A/A) types (Table 9).

Spring: Data gathered during spring 1977 reflected increased use of the A-S habitat type, which accounted for 61 percent of seasonal observations. Abundant new green herbaceous growth during early spring perhaps influenced use of this type. The Pp/A habitat type was the only other receiving any substantial use.

Summer: Although its use decreased from spring, the A-S habitat type continued to receive the heaviest use among types into the summer period, accounting for 37 percent of seasonal observations. Use of the Fp-Ar/Sa habitat type more then tripled from spring (Table 9). Mule deer were often observed in stands of buffaloberry within this type. The Pp/A habitat type also continued to receive substantial use during summer months. The only observed use of the agricultural cover type throughout the three season period was recorded during summer (Table 9).

Use of Slopes and Exposures

The pattern of use of slopes and exposures by mule deer differed from that of white-tailed deer (Tables 3, 4, 10 and 11). Gradients of 0-15 degrees received comparatively greater use by mule deer during all seasons (Table 10) but the proportion of those occurring on ridge tops and in drainage bottoms was greatest during fall (Table 11). Although slopes steeper than 15 degrees were used considerably throughout the year, those steeper than 45 degrees were rarely used by mule deer.

Among exposures, south facing slopes received comparatively greater use during winter and spring while west exposures were used more heavily during summer. No real trend was apparent during fall since slopes were used comparatively less during that season. As with white-tailed deer, seasonal occurrence among various slopes and exposures by mule deer appeared influenced by preferences for habitat types.

Table 9. Seasonal use of habitat types in the Long Pines study area by mule deer.

Habitat Type	Winter 1976-77 (310)[a]	Spring 1977 (180)	Summer 1977 (87)
Pinus ponderosa/Andropogon scoparius	5[b]	6	1
Pinus ponderosa/Agropyron	18	14	16
Pinus ponderosa/Rhus trilobata	10	7	4
Pinus ponderosa/Symphoricarpos albus	13	-	5
Agropyron-Stipa	33	61	37
Artemisia/Agropyron	13	6	4
Artemisia-Chrysothamnus	1	-	3
Fraxinus-Acer/Symphoricarpos albus	6	7	25
Populus tremuloides	-	-	-
*Populus/Symphoricarpos**	-	-	-
Agricultural Cover Type			
Cropland	-	-	-
Hay Meadow	-	-	3

[a] Sample size for a respective season.

[b] Percent of seasonal observations.

* The habitat type was identified following the data collection period.

Table 10. Seasonal use of four classes of gradient by mule deer.

Gradient	Fall 1976 (36)[a]	Winter 1976-77 (322)	Spring 1977 (281)	Summer 1977 (82)
0-15°	67[b]	44	64	65
16-30°	33	35	27	21
31-45°	-	21	9	12
46°+	-	-	-	2

[a] Sample size for a respective season.

[b] Percent of seasonal observations.

Table 11. Seasonal distribution of mule deer among flat lands and exposures.

Exposure	Fall 1976 (36)[a]	Winter 1976-77 (322)	Spring 1977 (281)	Summer 1977 (82)
Level Ridgetop	22[b]	17	19	5
Level Bottoms	42	16	12	43
North	3	22	13	2
East	14	7	12	15
South	14	24	34	16
West	6	15	10	20

[a] Sample size for a respective season.

[b] Percent of seasonal observations.

Food Habits

Fall

One rumen sample was obtained from a hunter-killed mule deer during late October. Browse constituted 59 percent of that sample. Among browse items used, snowberry and silver sagebrush (*Artemisia cana*) made up the bulk. Sunflower (*Helianthus* spp.) and aster accounted for most of the forbs in the sample.

Winter

Food habits of mule deer during winter were evaluated from examination of six feeding sites during January 1977. A method similar to that described by Wallmo et al. (1973), Wilkins (1957) and Lovaas (1958) was used, which resulted in 1,172 instances of use recorded among the six sites.

Browse accounted for 96 percent of the instances of use and occurred in the diet at all sites examined. Silver sagebrush was the most important item used during January. It averaged 37 percent of use among all sites and was used on four of the six sites. Other browse species, each of which was used at just one site and accounted for ten percent or more of the diet included horizontal juniper (*Juniperus horizontalis*), green rabbitbrush (*Chrysothamnus viscidiflorus*), and snowberry. A variety of forbs were used, none of which accounted for more than one percent of the diet during January nor was used at more than one of the six sites. Use of grass by mule deer during that period was negligible.

Population Characteristics

In the same manner as for white-tailed deer, if practicable, each mule deer observed was classified as to age, sex, and group type. As mentioned previously, more than 50 percent of the total sample was obtained from aerial surveys.

Group Behavior

Average group sizes of mule deer were larger than were those of white-tailed deer. This was perhaps related to differences in preferences for habitat types among the two species of deer since the largest groups of either species were generally associated with non-forested or savanna vegetational communities. Average group sizes of mule deer were 3.2, 5.3, 7.1 and 2.1 during fall, winter, spring, and summer, respectively.

Group composition among mule deer also differed from that among white-tailed deer. Mixed groups, which included both sexes of adults, whether or not accompanied by fawns, were quite often observed among mule deer (Table 12). Groups of adult does, accompanied by fawn(s) were observed more often among mule deer than among whitetails, particularly during winter.

Table 12. Group characteristics of mule deer in the Long Pines study area.

Group Class	Fall 1976	Winter 1976-77	Spring 1977	Summer 1977
Unclassified	-/ -	11/15	65/82	-/ -
Solitary Adult Male	14/ 4[a]	-/ -	2/tr[c]	5/ 2
Adult Male Group	-/ -	6/ 3	-/ -	12/21
Solitary Adult Female	-/ -	5/ 1	-/ -	30/14
Adult Female Group	7/ 7	6/ 5	5/ 3	10/13
Single Ad. Fe., and Fawn(s)	36/24	9/ 5	7/ 3	7/ 7
Ad. Fem. Group and Fawn(s)	21/27	34/38	-/ -	5/10
Mixed[b]	21/38	23/32	5/ 5	22/26
Fawns(s)	-/ -	2/tr	-/ -	5/ 5
Unclassified Adults	-/ -	3/ 1	15/ 8	2/ 2

[a] Percent of total groups observed during a respective period/percent of total animals observed during that period.

[b] Included groups containing adults of both sexes whether accompanied by fawns or not.

[c] tr - trace (a value less than .5 percent).

Except during fall, solitary adult bucks were rarely observed among mule deer. During summer mule deer bucks were more prone to occur in groups than were whitetail bucks. As would be expected, solitary adult does were often observed during summer (Table 12). Mixed groups were also common during that season. Since sex of adults was not readily determined throughout spring, no trend in group composition was available.

Population Structure and Postnatal Production

The fawn:doe ratio remained approximately the same from fall to early winter, while the buck:doe ratio decreased during that period (Table 13). As far as mule deer were concerned, only antlered bucks could be taken by hunters during fall 1976. The winter buck:doe ratio appeared to reflect a decrease in the buck segment of the population. The fawn:adult ratio remained above 40 fawns:100 adults through late winter but declined to 34:100 during spring (Table 13). This may have resulted from fawn mortality during the late winter - early spring period, although no mule deer carcasses were observed during spring and the following summer.

Data were insufficient during summer 1977 to evaluate production for the biological year beginning June 1. As compared to other seasons, summer buck:doe ratios were disproportionately high. It was inconceivable that recruitment of the previous year's male fawns into the population as yearlings would account for the high summer buck:doe ratios.

Antelope

During July 1977, each of the three subunits in the study area was surveyed with the use of a fixed-wing aircraft to determine summer habitat use, population structure and population levels of antelope (*Antilocapra americana*). A total of 384 antelope was classified throughout the study area of which 208 or 57 percent were observed in the Snow Creek subunit at the north end of the study area (Figure 1). The Speelman Creek subunit had the lowest population level or 14 percent of the total. All observations of antelope occurred in non-forested habitat types. Seventy-five percent occurred in the A-S habitat type and 18 percent occurred in the agricultural cover type. The remainder occurred in the A/A habitat type.

The Speelman Creek subunit in which the fewest number of antelope were observed, reflected the highest fawn:doe and buck:doe ratios among the three subunits (Table 14). Fawn:doe, fawn:adult, and buck:doe ratios throughout the study area were 88:100, 59:100, and 48:100, respectively. The study area comprises a portion of antelope hunting district 780. The entire hunting district was surveyed during July 1975 and produced a total of 1,462 antelope. Fawn:doe, fawn:adult, and buck:doe ratios from that survey were 94:100, 65:100, and 50:100, respectively.

Table 13. Population characteristics of mule deer in the Long Pines study area.

Season	Adults				Fawns	Total	Fawns: 100 Does	Fawns: 100 Adults	Bucks: 100 Does	Percent* Increment
	Fem.	Yr. M.	Ad. M.	Uncl.						
Winter 1976	26	5	5	-	15	51	58	42	38	29*
Early Winter 1976-77	51	10	5	-	29	95	57	44	29	31
Late Winter 1977	72	-	-	85	76	233	-	48	-	33
Spring 1977	-	-	-	208	71	279	-	34	-	25
Early Summer 1977	18	8	4	2	-	32	-	-	67	-
Late Summer 1977	23	6	14	-	12	55	52	28	87	22

* The proportion of the population consisting of fawns.

Table 14. Population characteristics of antelope in the Long Pines study area during July 1977.

Area	Adults		Fawns	Total	Fawns: 100 Does	Fawns: 100 Adults	Bucks: 100 Does	Percent Increment
	Females	Males						
Subunit 1	86	49	73	208	85	54	57	35[a]
Subunit 2	19	13	20	52	105	62	68	38
Subunit 3	58	16	50	124	86	68	28	40
Total	163	78	143	384	88	59	48	37

[a] The proportion of the population consisting of fawns.

Upland Game Birds

Three species of upland birds were observed on the study area during the report period. Included were Merriam's turkey (*Meleagris gallopavo merriami*), Hungarian partridge "huns" (*Perdix perdix*), and sharp-tailed grouse(*Pediocecetes phasianellus*), of which only the latter is native to Montana.

Turkeys were introduced in the Long Pines during January 1955 when 18 birds were released near Capital Rock (Greene and Ellis 1971). This represented one of the first successful attempts to introduce this species to Montana. From 1957 through 1959, 225 turkeys were trapped in the Long Pines and released in other areas in Montana. A study was undertaken by the Fish and Game Department from 1961-1963 in the Long Pines to determine ecological relationships and life history of this subspecies in this northern extension of its range (Jonas 1966). All turkeys observed during the report period occurred within the National Forest boundary, (Figure 2) although a flock was known to have wintered within the study area off the south end of the forest on private land.

Huns were distributed throughout the state by the Montana Fish and Game Commission from 1922 to 1926 but this species is presently confined to prairie regions of the state (Trueblood and Weigand 1971). Several sightings were made within the study area during the report period, all of which were confined to the Speelman Creek drainage.

Sharp-tailed grouse were observed throughout the study area including both forest and private lands (Figure 3). During March and April 1977, an attempt was made to locate as many dancing grounds as time would allow. Several grounds were located by talking to several ranchers living on the study area. Others were found on routine surveys during early morning and late evening hours. Eight grounds were located during the report period, of which seven occurred on private land adjacent to the national forest (Figure 3). The one ground located on the forest occurred in the Snow Creek drainage. The others occurred in the Speelman Creek, Slick Creek, and Tie Creek drainages. Winter concentrations of sharp-tailed grouse along Speelman and Tie Creeks occurred in close proximity to existing dancing grounds (Figure 3). Three of the four broods observed during summer 1977 occurred on Speelman Creek and all three occurred within 1.5 miles of a dancing ground.

Fall Food Habits

Foods eaten by turkeys and sharp-tailed grouse during fall 1976 were determined from analysis of the contents of five and three crops, respectively, taken from birds killed by hunters (Table 15). Specific parts of plants used were noted.

Turkey

Plant and animal material constituted 67 and 33 percent of the average volume of the five crops, respectively. Among plant material consumed,

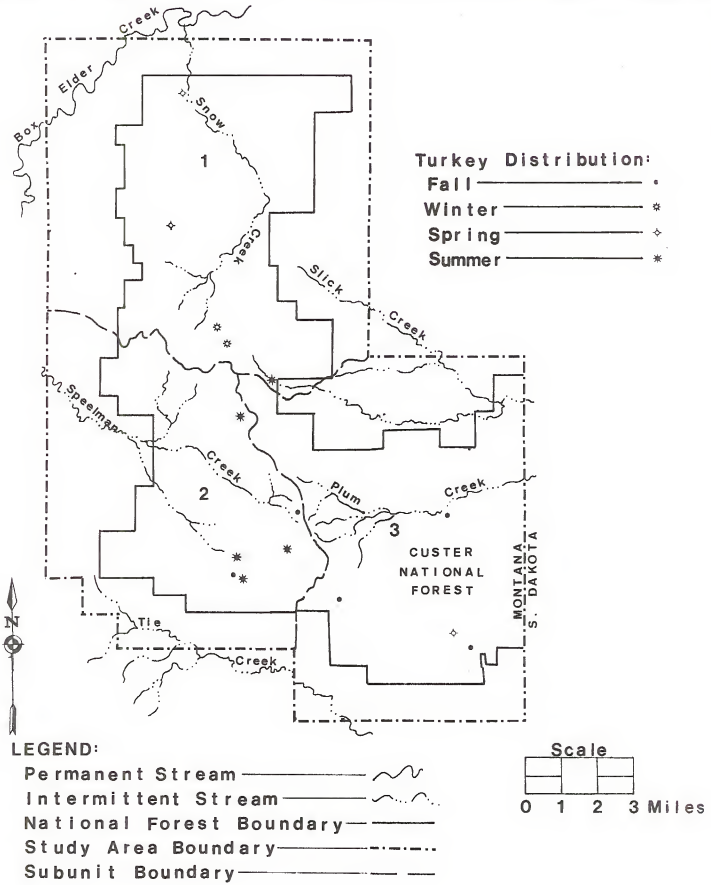

Figure 2. Locations of sightings of Merriam's turkey in the study area by season from September 1976 through August 1977.

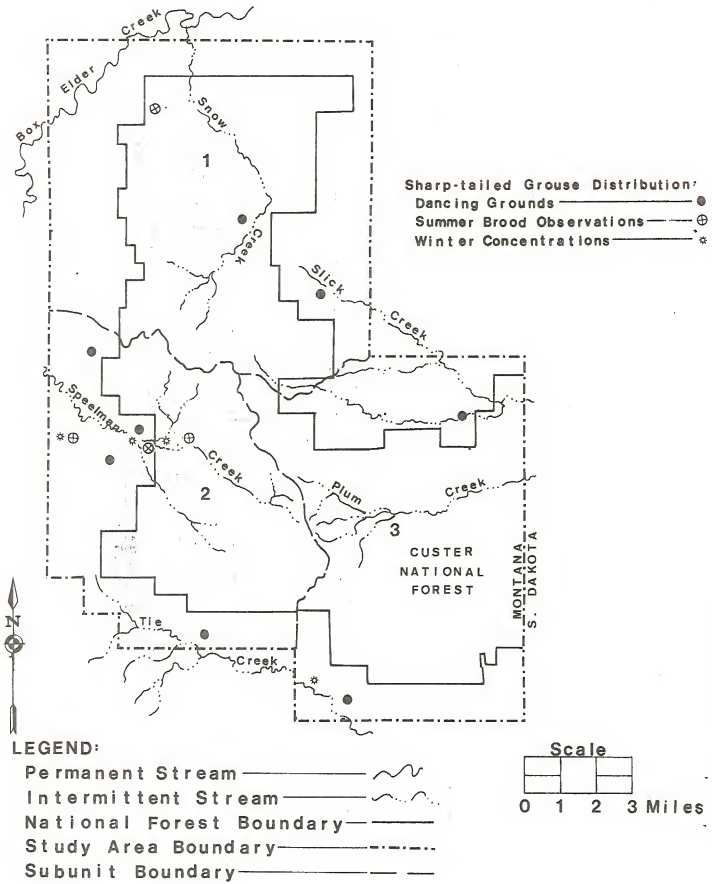

Figure 3. Locations of observed winter concentrations, dancing grounds, and broods of sharp-tailed grouse in the study area from December 1976 through July 1977.

Table 15. Fall foods of turkeys and sharp-tailed grouse as determined from analysis of crops from hunter-killed birds.

Taxa	Turkey 5 Crops	Sharp-tailed Grouse 3 Crops
Plant Material:		
Andropogon scoparius (seeds)	20/tr[a]	-
Anemone patens (leaves)	-	33/ 1
Berberis repens (fruit)	40/ 5	-
Crataegus succulenta (fruit)	40/ 5	33/18
Pinus ponderosa (needles)	40/tr	-
Poa spp. (leaves)	20/ 3	-
Poa spp. (seeds)	60/ 7	-
Ratibida columnifera (seeds)	100/22	33/tr
Rhus trilobata (fruit)	60/ 1	-
Rosa arkansana (fruit)	40/21	67/47
Solidago spp. (leaves)	-	33/tr
Symphoricarpos spp. (fruit)	60/ 2	33/ 4
Symphoricarpos spp. (leaves)	20/tr	-
Taraxicum officinale (leaves)	20/tr	67/ 3
Tragopogon dubius (seedheads)	40/tr	-
Tragopogon dubius (leaves)	-	33/14
Triticum aestivum (seeds)	20/tr	-
Unidentified Forbs (leaves)	80/tr	100/10
Unidentified Grasses (leaves)	100/ 1	100/ 1
Unidentified Shrubs (stems)	-	33/tr
TOTAL	100/67	100/98
Animal Material:		
Arachnida	60/tr	-
Coleoptera	60/tr	67/ 2
Diptera	20/tr	-
Hemiptera	40/tr	-
Hymenoptera	40/tr	-
Orthroptera	80/33	-
Insect Larva	40/tr	-
TOTAL	100/33	67/ 2
Other Material:		
Gravel	40/tr	-

[a] Frequency (percent occurrence among samples)/average volume among samples.

tr - Trace (a value less than .5 percent).

seeds from prairie coneflower, fruit from prairie rose, and seeds from bluegrasses together accounted for 50 percent of the fall diet. Insects accounted for nearly all of the animal material used by turkeys during fall. Grasshoppers (*Orthroptera*) represented nearly all of the use of insects (Table 15). Grasshoppers were much more abundant in samples taken during September than they were during October.

Sharp-tailed Grouse

Plant material made up 98 percent of the average volume among the three samples. Rose hips were the most abundant items occurring among the samples followed by fruit from fleshy hawthorn (*Cretaegus succulenta*) and leaves from common salsify (*Tragopogon dubius*) (Table 15). Fruits and seeds made up approximately 69 percent of the diet. Beetles (*Coleoptera*) accounted for all of the use of insects.

Production

Five turkey brood flocks (Jonas 1966) were observed during summer 1977 (Table 16). Brood flocks contained an average of 15.4 poults and two or three adult hens. The average number of poults per hen was 6.4.

All four sharptail broods were observed during July. Locations of these sightings appear in Figure 3. Thirty-three chicks were observed among the four broods averaging 8.2 young per hen.

Only one brood of huns was observed during the summer (Table 16). It contained one hen and 17 young.

Nongame Wildlife

Two studies were initiated during summer 1977 dealing with the nongame wildlife aspect of the overall project. Both dealt with nongame birds. A graduate study conducted by a student from Montana State University, Bozeman, was initiated during June to determine breeding densities and species composition of songbirds within several vegetational communities in the Long Pines study area. Field work related to this study will cover the summers of 1977 and 1978 and the spring of 1978. A description of work accomplished to date, methodologies and a species list appear in Appendix A. A two-month survey and inventory dealing with raptorial birds on the study area and including an analysis of the potential effects of uranium mining was conducted by a graduate student from Washington State University, Pullman. Progress to date concerning that research appears in Appendix B.

More than 50 species of mammals were reported as occurring in Carter County of which the study area is a part (Lampe et al.1974). Thirty-two species of nongame mammals were known to occupy the study area (Table 17). In the future it would be desirable to obtain information related to species diversity and relative abundance of nongame mammels in the various habitat types within the study area.

Table 16. Upland game bird brood production in the Long Pines study area during 1977.

Species	No. Broods	No. Young	No. Hens	Average Brood Size	No. Young: Adult Hen
Merriam's Turkey	5*	77	12	15.4*	6.4
Sharp-tailed Grouse	4	33	4	8.2	8.2
Hungarian Partridge	1	17	1	-	17.0

* In the case of Merriam's turkey, individual broods combine when young are 7-10 days old, thus forming brood flocks.

Table 17. Nongame mammals known to occur in the Long Pines study area.*

Order	Species	Vernacular
Insectivora	*Sorex cinereus*	Masked Shrew
	Sorex merriami	Merriam Shrew
Chiroptera	*Myotis evotis*	Long-eared Myotis
	Myotis leibii	Small-footed Myotis
	Myotis lucifugus	Little Brown Myotis
	Lasionycteris noctivigans	Silver-haired Bat
	Eptesicus fuscus	Big Brown Bat
	Lasiurus cinereus	Hoary Bat
	Plecotus townsendii	Townsends Big-eared Bat
Lagomorpha	*Lepus townsendii*	White-tailed Jackrabbit
	Sylvilagus audubonii	Desert Cottontail
	Sylvilagus floridanus	Eastern Cottontail
Rodentia	*Eutamias minimus*	Least Chipmunk
	Spermophilus tridecemlineatus	Thirteen-lined Ground Squirrel
	Tamiasciurus hudsonicus	Red Squirrel
	Thomomys talpoides	Northern Pocket Gopher
	Perognathus fasiatus	Olive-backed Pocket Mouse
	Perognathus hispidus	Hispid Pocket Mouse
	Castor canadensis	Beaver
	Reithrodontomys megalotis	Western Harvest Mouse
	Peromyscus maniculatus	Deer Mouse
	Neotoma cinerea	Bushy-tailed Woodrat
	Microtus ochrogaster	Prairie Vole
	Microtus pennsylvanicus	Meadow Vole
	Mus musculus	House Mouse
	Zapus hudsonius	Meadow Jumping Mouse
	Erithizon dorsatum	Porcupine
Carnivera	*Canis latrans*	Coyote
	Vulpes vulpes	Red Fox
	Procyon lotor	Raccoon
	Mustela frenata	Long-tailed Weasel
	Mephitis mephitis	Stripped Skunk

* From species account of Lampe et al. 1974

Evaluation of Recreational Use

Hunting was the most obvious form of recreation that occurred in the national forest portion of the study area. Campers and picnickers used the Long Pines during summer, and snowmobilers used the area in the winter. A spring turkey gobbler season offered recreational opportunities during part of April. Only recreational use during the 1976 fall hunting season was evaluated.

Traffic counters were placed at three entrances to the forest during mid-September: Snow Creek entrance, Speelman Creek entrance, and the southeast entrance below Capital Rock. Those three entrances were believed to receive the heaviest use. Each counter was read just prior to and following each weekend from September 18 through the end of the hunting season on November 21. The data will serve as indices to compare use between weeks, weekends, and years. Questionnaires were given to 82 hunting parties from September 19 through November 21. The purpose of the questionnaire was to determine the proportion of resident and non-resident hunters using the Long Pines, what parts of the state and nation were represented, effort devoted to hunting turkey and deer, and hunter success.

Although traffic data at all three locations reflected the same trend throughout the hunting season, the Speelman Creek entrance received the heaviest use among the three exits. Fifty-six percent of the weekly use throughout the period occurred during weekends. Maximum use of the area occurred during the first week of the general big game season which commenced October 24 (Figure 4). Hunter use of the area dropped off sharply after November 6, which was the half-way point of the four-week deer season.

Forty-three of the 82 questionnaires were returned representing a response of 52 percent. Two questionnaires were used: one for turkey hunters only was distributed from September 19 through October 23; the other included both turkey and deer harvest information. During the initial period, 9 of 10 responding parties were resident hunters, most of whom were from Fallon County. Of 33 responding parties who were contacted from October 24 through November 21, 58 percent were nonresidents. Seventy-nine percent of responding nonresident parties hunted during the first two weeks of the general big game season, which corresponded with peak use of the area as indicated by traffic data (Figure 4). Only 37 percent of responding resident hunting parties hunted in the Long Pines during the first two weeks of the deer season. Fifty-six percent of responding residents hunted turkeys there prior to the opening of deer season. Minnesota accounted for 56 percent of all responding nonresident hunting parties. Of all resident parties responding, 48 percent were from Fallon County.

Among the responding parties 78 hunters bagged 14 turkeys for a success ratio of 18 percent. Four mule deer and 35 white-tailed deer were taken by 92 hunters for a success ratio of 45 percent. The success ratio on deer may be somewhat misleading when compared to statewide figures since that figure only applies to percent success within the Long Pines. Many

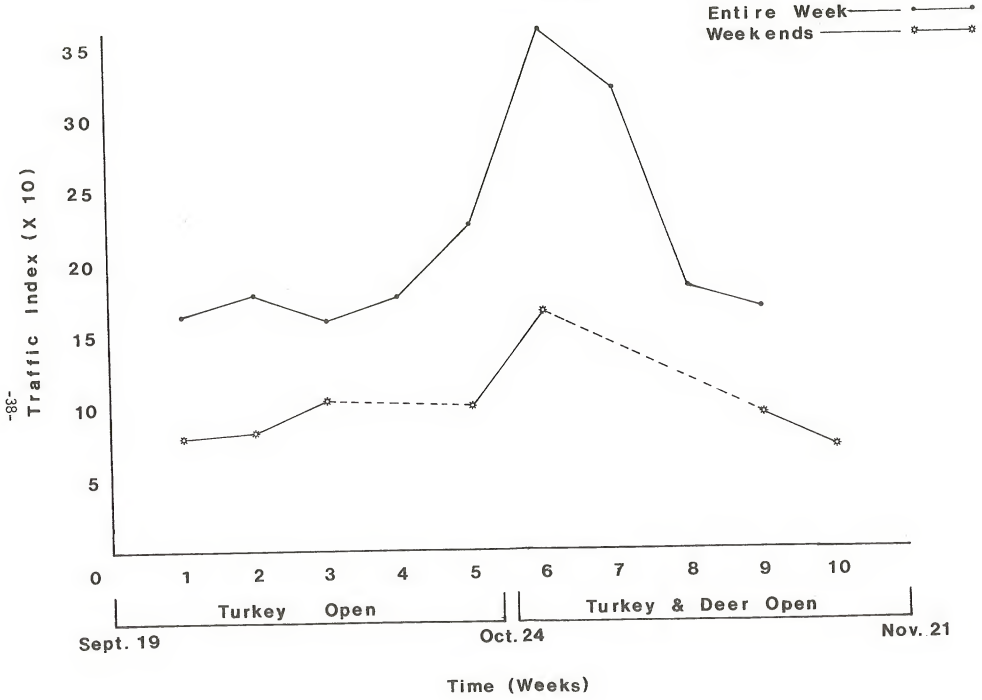

Figure 4. Trends in weekly and weekend use of the portion of the study area consisting of National Forest from September 19 through November 21, 1976 as determined from the use of traffic counters at three locations.

residents who hunted in the Long Pines and were unsuccessful there may have gotten a deer elsewhere.

Department law enforcement personnel, who had worked the Long Pines during the general big game season the previous two years, felt that hunter numbers, particularly those of nonresidents, were considerably less during 1976. Increased nonresident license fees and a reduced bag limit, from two to one deer, perhaps influenced such a decline. In Region 7, which includes the southeastern portion of the state and includes the study area, 9,634 nonresident deer hunters were afield during 1975 as compared to 2,055 during 1976 (Mussehl 1977).

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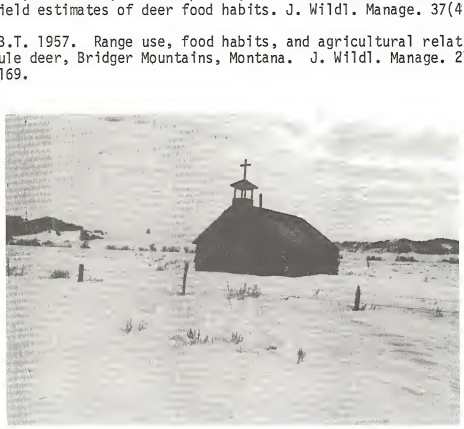

APPENDIX

BREEDING BIRDS STUDY - Long Pines

Progress Report

by

Kristi DuBois

October 1977

A study to determine breeding bird densities was initiated in June 1977 in the Long Pines of southeastern Montana. The purpose of the study was to gather baseline data in light of possible uranium mining.

Breeding songbird densities were determined by mapping territorial pairs on plots representative of the major vegetation types in the Long Pines. Three 16-hectare plots were set up, one each in ponderosa pine forest, ponderosa pine savannah and prairie. The plots were 400 meters on a side and gridded throughout at 50-meter intervals. Every other 50-meter line was walked, with the birds mapped to 50 meters either side of the line.

Drainageways with deciduous trees (trembling aspen, green ash, boxelder and paper birch) ran through the other habitat types. The birds inhabiting these areas were mapped by walking the drainage and plotting birds found within 50 meters on either side. Two transects, each just over 2 kilometers long, were set up along deciduous draws in ponderosa pine forest, savannah and prairie types.

Songbird territories were determined by mapping singing males during their periods of most intense activity. Most mapping was done in the mornings, starting shortly before sunrise and ending around 10:00 a.m. (depending upon singing activity). Mapping began in April and continued through early July. Nest locations, female birds and fledglings were also mapped whenever possible.

Species composition by habitat types were obtained by doing 3-minute bird counts along a transect route through the Long Pines. Twenty stops were set up along the route, five stops each in ponderosa pine forest, savannah, prairie and deciduous types. Observations of birds of prey were plotted on maps when observed throughout the Long Pines.

During early September 1977, the three plots and two deciduous draw transects were photographed from the air with color infrared film. These photos were used, along with field data, to map the vegetational units in detail. A literature search was also conducted to obtain information on breeding bird densities and possible environmental impacts of uranium mining.

The following birds were observed in the study area during summer 1977.

1. Mallard
2. Turkey Vulture
3. Sharp-shinned Hawk
4. Cooper's Hawk
5. Red-tailed Hawk
6. Swainson's Hawk
7. Golden Eagle
8. Marsh Hawk
9. Prairie Falcon
10. Merlin
11. Sparrow Hawk
12. Sharp-tailed Grouse
13. Ring-necked Pheasant
14. Gray Partridge
15. Turkey
16. Killdeer
17. Long-billed Curlew
18. Willet
19. Rock Dove
20. Mourning Dove
21. Great Horned Owl
22. Poor-will
23. Common Nighthawk
24. White-throated Swift
25. Belted Kingfisher
26. Common Flicker
27. Hairy Woodpecker
28. Downy Woodpecker
29. Eastern Kingbird
30. Say's Phoebe
31. Least Flycatcher
32. Horned Lark
33. Violet-green Swallow
34. Cliff Swallow
35. Blue Jay
36. Black-billed Magpie
37. Common Crow
38. Black-capped Chicadee
39. White-breasted Nuthatch
40. Red-breasted Nuthatch
41. House Wren
42. Canyon Wren
43. Rock Wren
44. Robin
45. Mountain Bluebird
46. Red-eyed Vireo
47. Yellow-rumped Warbler
48. Ovenbird
49. Common Yellowthroat
50. Yellow-breasted Chat
51. American Redstart
52. Western Meadowlark
53. Red-winged Blackbird
54. Brewer's Blackbird

55. Brown-headed Cowbird
56. Western Tanager
57. Black-headed Grosbeak
58. Indigo Bunting
59. Lazuli Bunting
60. American Goldfinch
61. Red Crossbill
62. Rufous-sided Towhee
63. Lark Bunting
64. Grasshopper Sparrow
65. Lark Sparrow
67. Dark-eyed Junco
68. Chipping Sparrow
69. Field Sparrow

AN ASSESSMENT OF POTENTIAL CONFLICTS BETWEEN BIRDS OF PREY AND HUMAN ACTIVITIES IN THE LONG PINES

Progress Report

October 1977

George T. Allen

The purpose of this project was to assess the effects of human activity on birds of prey in the Long Pines, and to suggest ways of minimizing such problems. Of particular interest were problems associated with uranium exploration and/or mining. A search for commercially valuable uranium deposits is being carried out in the Long Pines, largely by Mobil Oil Corporation.

For this study, boundary and section identification established by the Department of Fish and Game were used. Field work was conducted between 14 June and 21 July 1977. Work in other areas such as the Ekalaka Hills and Chalk Buttes was helpful, for it added information on nesting times and productivity. Some sightings were obtained from Dale Becker (USFS) or from Kristi Dubois, who is currently doing her Master's work in the Long Pines study area.

The following information is a summary of data gathered during June and July 1977 and pertinent information from various references. An attempt was made to estimate nesting periods for raptorial birds found in the study area. Estimates of productivity, and comparisons from other areas (Ekalaka Hills and Chalk Buttes) are not yet evaluated. This information is preliminary, and may be changed at a later date, when all information has been evaluated. No density figures were included. This was a one-summer survey, and it has been typically true in other areas that it takes several years to find all potential nesting areas for birds of prey. Such was the case for the Long Pines area.

Methods

After the techniques of others (Olendorff 1973, 1975; O'Brien and Pulkrabek 1974; Pulkrabek 1975, 1976), observations were oriented toward prairie falcons (*Falco mexicanus*) and golden eagles (*Aquila chrysaetos*). To gather information about these species potential nesting habitat was surveyed by vehicle and on foot. In the Long Pines such habitat was largely comprised of cliffs overlooking prairie and such cliffs were particularly evident along the western and southern borders of the national forest lands in the study area. Binoculars and a spotting

scope were used to search for likely nesting areas, and then such areas were surveyed further on foot. Observations of merlins (*Falco columbarius*) generally resulted incidental to closer searches for prairie falcon and golden eagle nests. Wherever practical, young birds were banded. Records were kept of brood size, fledgling success, nest exposure, prey items, and anything unusual.

Other raptors were observed when searching for the species above, or when traveling through the study area for any reason.

Woodland nesting species such as Cooper's (*Accipiter cooperii*) and sharp-shinned (*Accipiter striatus*) hawks were only occasionally found using such methods. To adequately census these birds in the Long Pines would require many days of walking through the heavily wooded areas, and would probably require more people to survey the study area. Nocturnally active species such as the great horned owl (*Bubo virginanus*) will not often be seen in diurnal observations, and a census of such species would also be difficult in the Long Pines.

Results

The following species were noted as actual or probable nesting species in the Long Pines study area:

Cooper's hawk - This species had not been recorded as nesting in eastern Montana before 1976. Skaar (1975, 1976, 1977) indicated that there was only one latilong with substantiated nesting records east of the Livingston area. One Cooper's nest was found in the study area on 20 July - the first record of this species breeding in the Ekalaka latilong. The nest located had at least four young, three of which fledged. There were probably more nests of this species in the study area, but they were very difficult to locate. Incubation for this species takes 36 days and fledgling takes 32 more (Brown and Amadon 1968). The date of fledgling for the birds in the nest we found (20 July) therefore indicates that egg-laying for this species started about the second week of May 1977, meaning that nesting activities for this species perhaps began about early or mid-April.

Sharp-shinned hawk - Dependent young of this species were seen near Lantis Spring on 25 July. This was also the first substantiated record of nesting in the Ekalaka latilong for this species (Skaar 1977). A number of other sightings were recorded in the study area, but like the Cooper's hawk, nests of this species were difficult to locate. There were perhaps a number of sharp-shin nests in the Long Pines each year. Incubation of eggs of this species takes about 34-35 days and fledgling takes another 23 days (Brown and Amadon 1968), so nesting of this species probably began in early or mid-April. Breeding activities, of course, began earlier.

The two species above exhibit antagonistic behavior during the nesting season, and nests of the two would not be expected to be located in proximity to each other. This antagonism and the similarities in hunting methods and prey will serve to limit population densities of both species in the study area.

Harrier (*Circus cyaneus*) - No nests of this species were found. This species nests most commonly in "open grassy situations" (Bent 1938), and nests would most likely be found in the less disturbed grassland or marsh areas throughout the study area. Perhaps a concentrated effort to locate harrier nests in the Long Pines would be successful, for numerous observations of this species were made. Clutches of this species are laid around late April and the first half of May, the incubation period is 29-39 days, and fledgling takes another 36 days (Brown and Amadon 1968). The fledgling date should therefore be from mid-June to mid-July.

Red-tailed hawk (*Buteo jamaicensis*) - One nest and several approximate nest locations of this species were found in the study area, and many were also found in the Ekalaka Hills and the Chalk Buttes. This is another species for which there were no definite breeding records for the Ekalaka latilong prior to this study (Skaar 1977). Red-tails are the only common buteo in the study area during summer. Fledgling of young occurred around 10 July, following an incubation period of about 30 days and a nestling period of approximately 45 days (Brown and Amadon 1968). For red-tails in the Long Pines area, egg-laying therefore occurred about mid or late April. According to Brown and Amadon (1968), courtship behavior goes on for some time prior to this, and nests may be built as much as two months earlier. The nesting period for red-tails might therefore run from as early as mid-February until about mid-July. It should also be noted that red-tails are considered among the most tolerant of all raptorial species of human activities (Olendorff 1975).

Golden eagle - One nest of this species was located in the study area on 1 July, and perhaps one bird fledged from this nest. Several other nests were located in the Ekalaka Hills and the Chalk Buttes. There were no substantiated records for breeding of golden eagles in the Ekalaka latilong before this summer (Skaar 1977). Fledgling for this species in the Long Pines area occurs around the beginning of July. Incubation has been reported at from 41 to 45 days (Brown and Amadon 1968, Camenzind 1969, Beecham 1972, Olendorff 1973). An average of 43, coupled with a nestling period of 65-70 days (Brown and Amadon), suggested this species laid eggs about the third week of March in the Long Pines area. Courtship activities begin long before this time, however, and Baglien (1975) indicated that golden eagles arrive in the Madison Basin in Montana in late February and early March. These dates may be later in the Long Pines area. Some of these birds also known to winter in the study area.

After spending the summer in the Long Pines area I feel that this species faces the most severe problems of any raptor in the Long Pines area. Persecution of this bird may be severe in some parts of the study area and its surroundings, and uranium activities may compound the problems eagles face.

Prairie falcon - Six aeries and the approximate location of another were found in the study area. In addition, numerous aeries were found in the Ekalaka Hills and the Chalk Buttes, so fairly good productivity and fledgling information was gathered. Several of the aeries in the study area were located in sections in which Mobil Oil Corporation has active uranium claims, and would therefore possibly be subject to disturbance of their nesting activities. Fledgling dates for the young of this species in the Long Pines, Ekalaka Hills, and the Chalk Buttes ranged from about 21 June to 5 July. A 30 day incubation period and a 40 day nestling period (Brown and Amadon 1968) mean that clutches may be complete as early as the third week of April for this species in the Long Pines area. Enderson (1964) noted that individual nests of prairie falcons were as much as one month out of phase in a Colorado study, and this was found to be so in the Long Pines, Ekalaka Hills, and the Chalk Buttes. While Skaar (1975, 1976) listed the prairie falcon as the one raptor with a substantiated breeding record in the Ekalaka latilong, it was apparently little known to most residents of the area.

Merlin - This is another species for which there were no previous records of nesting in the Long Pines area (Skaar 1977). This species was very difficult to census. Pulkrabek (1976), in describing his studies in Harding County, South Dakota, stated that "The merlin presents its own set of problems. The first problem encountered was that there was only a short period of time when adults were protective enough to their nest sites to indicate its position and even then an observer must be very near the nest tree before the defense display can be helpful in locating the nest." In their report on studies in the same area, O'Brien and Pulkrabek (1974) stated that "While they saw many merlins and many pairs displaying nesting behavior, only three nests were found. It would not be unrealistic to say that, once a pair was located, it might easily take a full day to determine which, of a myraid of trees, contains the nest." The approximate locations of four nests in the Long Pines were noted, but no productivity figures were obtained. One nest and the young was located in the Ekalaka Hills on 8 July, and this gave evidence of breeding and nesting times. Incubation for this species takes 28-32 days (Fox 1964, Brown and Amadon 1968) and the nestling period between 25 and 35 days (Trimble 1975), a good average being 25-27 (Brown and Amadon 1968). Oviposition for merlins in the study area therefore takes place in late April and early May.

Kestrel (*Falco sparverius*) - The kestrel is widespread in the study area, and one certain and a number of approximate nest locations were found. Brown and Amadon (1968) indicated that kestrels have laying dates from mid April to early June, with incubation and nestling periods

of 30 days each. They also indicated that mating may precede egg-laying by up to six weeks. The reproductive period for kestrels in the Long Pines can therefore be expected to run from perhaps the beginning of March until the end of July.

Great horned owl (*Bubo virginanus*) - On two occasions great horned owls were observed while traveling through the study area after dark. No young of this species were observed in the study area; some were noted near Ekalaka, this species may nest in the study area itself. In Montana Bird Distribution, Skaar (1975) noted that there was circumstantial evidence for the breeding of this species in the Ekalaka latilong. Assuming that great horned owls do actually nest in the Long Pines, they initiated nesting much earlier than did other raptors. Olendorff (1975), in his studies on the Colorado plains, found that these birds initiated nesting during winter months, often as early as December. A nestling period of about 65 days (Karalus and Eckert 1974), following an incubation period of from 21 to 35 days (Austing and Holt 1966, Karalus and Eckert 1974), mean that these birds probably fledge in May in the vicinity of the Long Pines.

Turkey vulture (*Cathartes aura*)- A number of vultures were sighted at various times in the Long Pines, in the Ekalaka Hills, and in the Chalk Buttes. No nests were found, nor were any roosts located, so where this species nested in the area of the Long Pines was uncertain. Skaar (1977) indicated that there is circumstantial evidence for the nesting of turkey vultures in the Ekalaka latilong. Nesting for this species begins in May or June, and incubation and the nestling period combined take about 110-120 days (Brown and Amadon).

There was perhaps a great deal of confusion of turkey vultures and golden eagles in the Long Pines area - especially when livestock were involved.

Other Species

Swainson's hawk (*Buteo swainsoni*) - On two occasions Swainson's hawks were sighted in the study area. One of these occasions was in June, the other in September (an observation by Kristi DuBois). Swainson's hawks are known as the last to arrive and the first to leave their breeding grounds. This, coupled with the fact that this species was not seen in the study area other than on these two occasions suggested that these two birds were migrants. Skaar (1977) indicated that there is only circumstantial evidence for breeding of Swainson's hawks in the Ekalaka latilong.

Ferruginous hawk (*Buteo regalis*) - No ferruginous hawks were observed in the study area, but others reported that they were nesting south of the Chalk Buttes. They may nest around the Long Pines if this is so.

Short eared owl (*Asio flammeus*) - This species was also apparently reported nesting southwest of the study area, and I am checking on these reports at this time.

Mining

Since the purpose of this project was to determine what may be the potential conflicts between human activities, particularly uranium exploration and mining, and the raptors of the study area, some time was spent this summer checking on the location of mining claims and leases held in the Long Pines area.

Some time was devoted to studying solution or in-situ mining of uranium. This technique appears to be the only practical way to produce uranium from the Long Pines area, since the uranium-bearing strata lie about 800 to 1200 feet below the surface. Solution mining also allows production from lower grade strata than does underground or open pit mining. Some time was also spent studying the environmental effects of the technique to better analyze its potential effects in the Long Pines area.

Mobil Oil Corporation has been helpful in providing information about their efforts in the Long Pines, and through them I hope to be able to get accurate information that I may need.

At this time I am working on the maps and charts for my project, and I am also gathering information about raptors, solution mining, and the Long Pines area.

I wish to thank the following people for their help in the project:

Gary Dusek, Biologist - Montana Department of Fish and Game

Bob Martinka, Bureau Chief for Baseline Studies - Montana Department of Fish and Game.

Ken Walcheck, Information Officer - District 7, Montana Department of Fish and Game.

Tom Komberec, Biologist - Montana Department of Fish and Game.

Tim Kelly, Project Geologist - Mobil Oil Corporation.

John Hurley, Project Geologist - Mobil Oil Corporation.

Robert Hamner, District Ranger - Sioux District, Custer National Forest.

Ken McLaughlin, Timber and Minerals Assistant - Sioux District, Custer National Forest.

Gene Hoff - Carter County Agent

Keith Stevens - Stevens Flying Service

Dale Becker

Kristi DuBois

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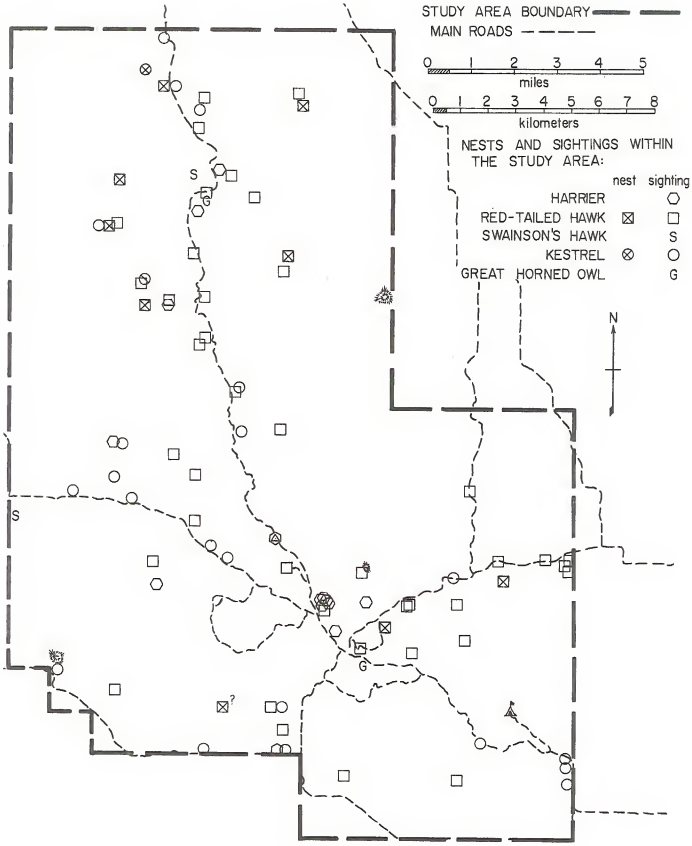
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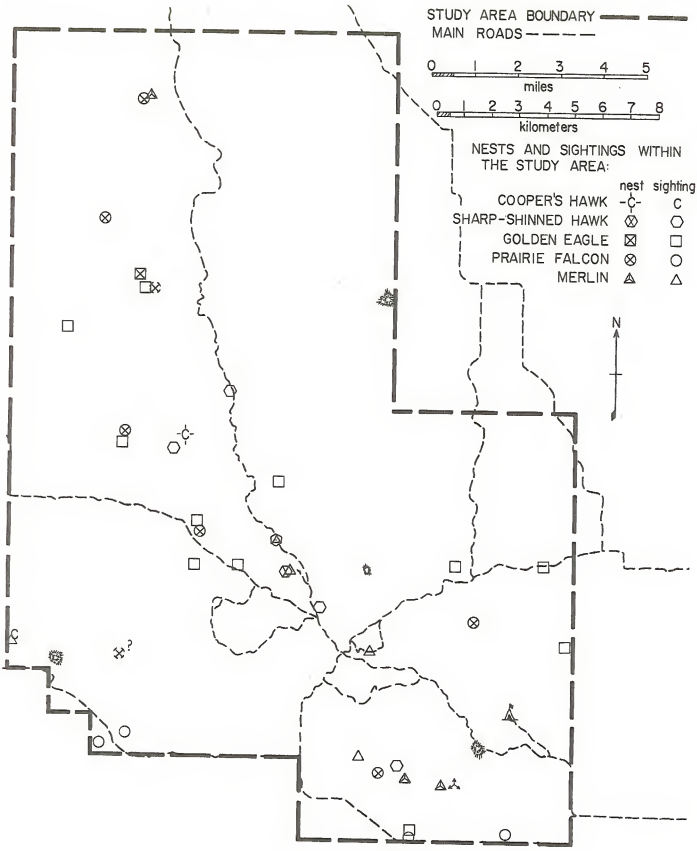
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PRAIRIE FALCON
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